J. W. GAMBLE.

WATER HEATER.

APPLICATION FILED OCT. 12, 1910.

991,970.

Patented May 9, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

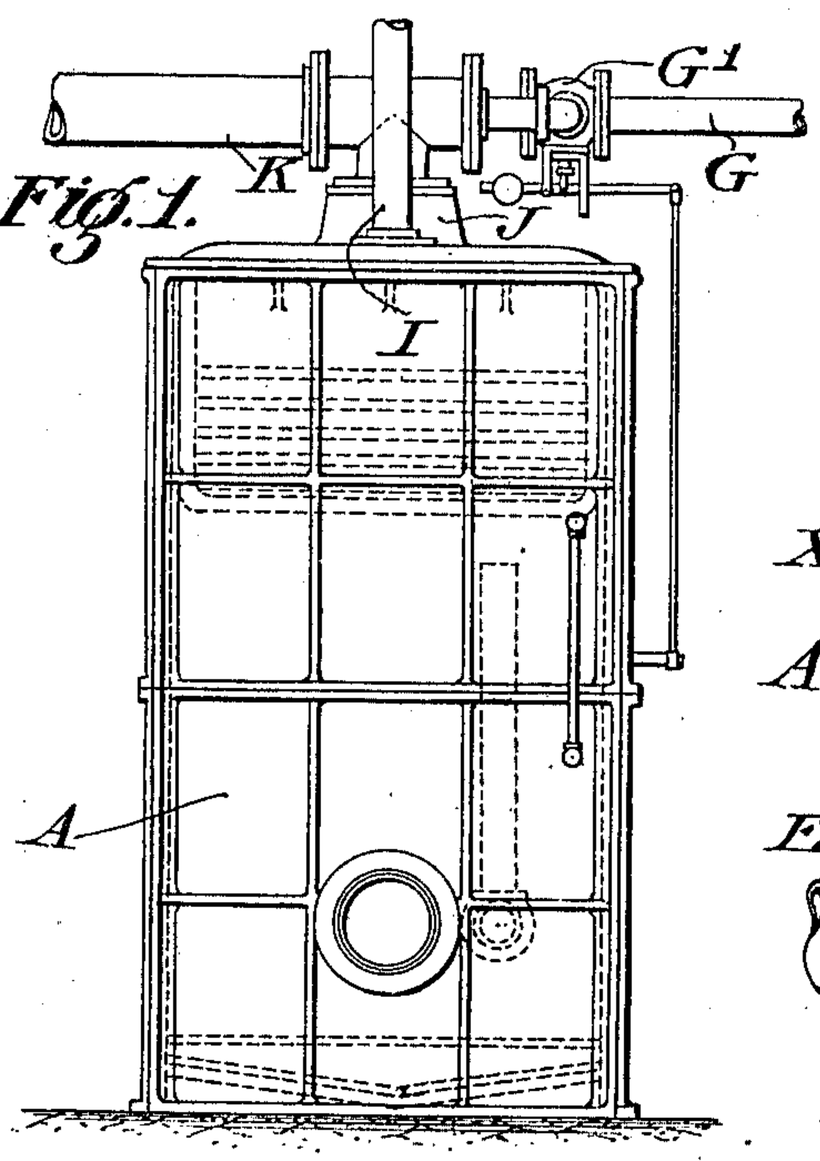


Fig. 2.

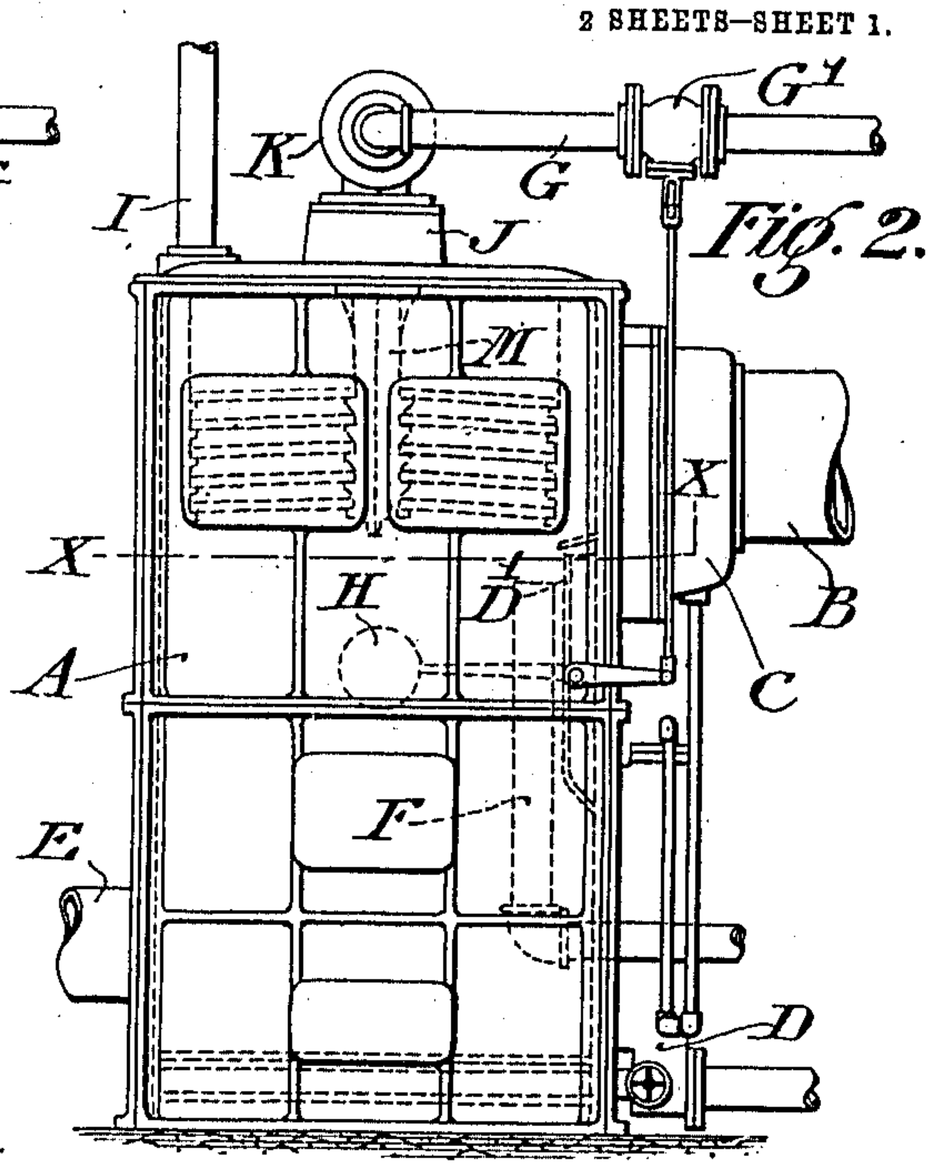
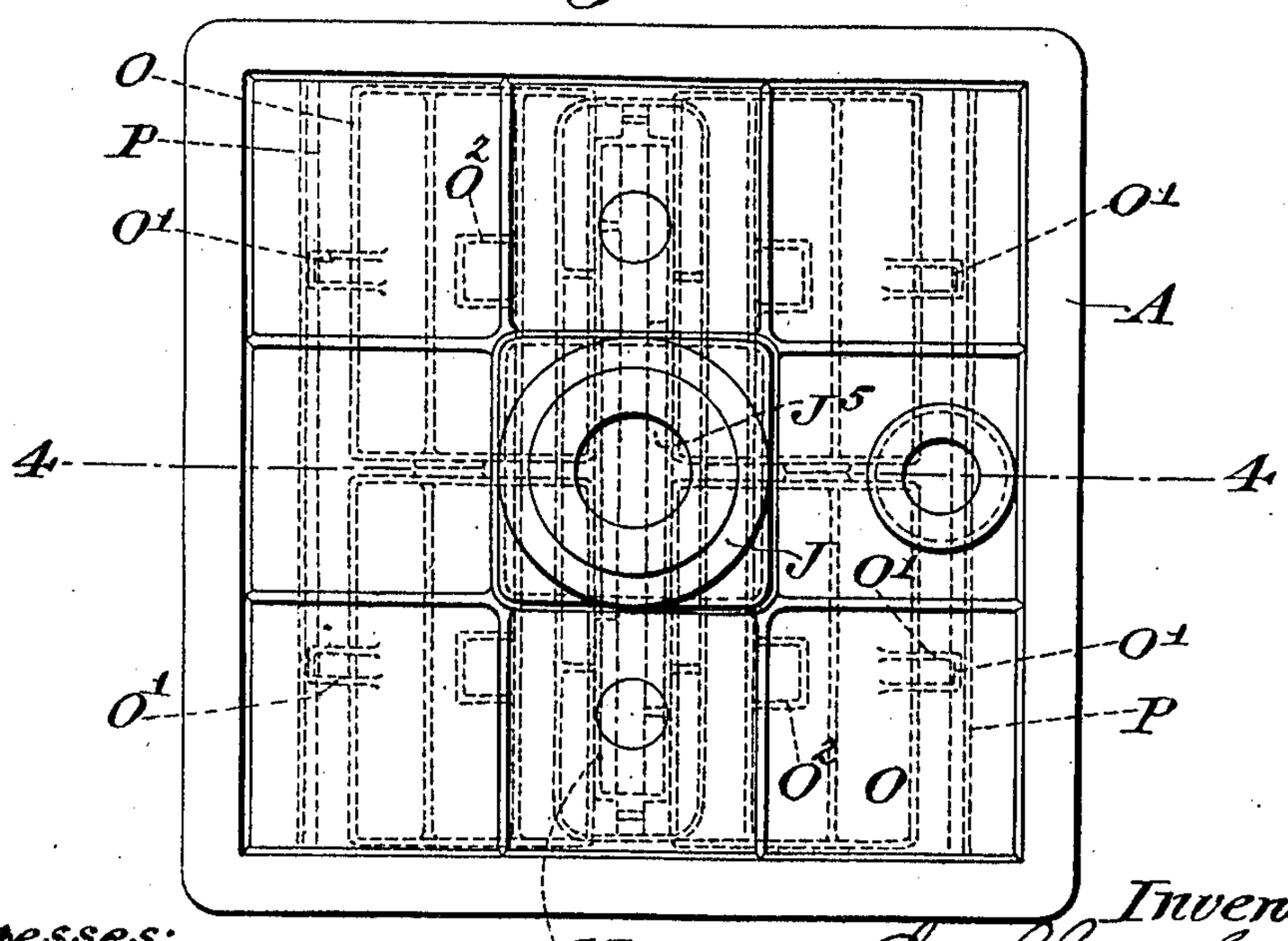


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

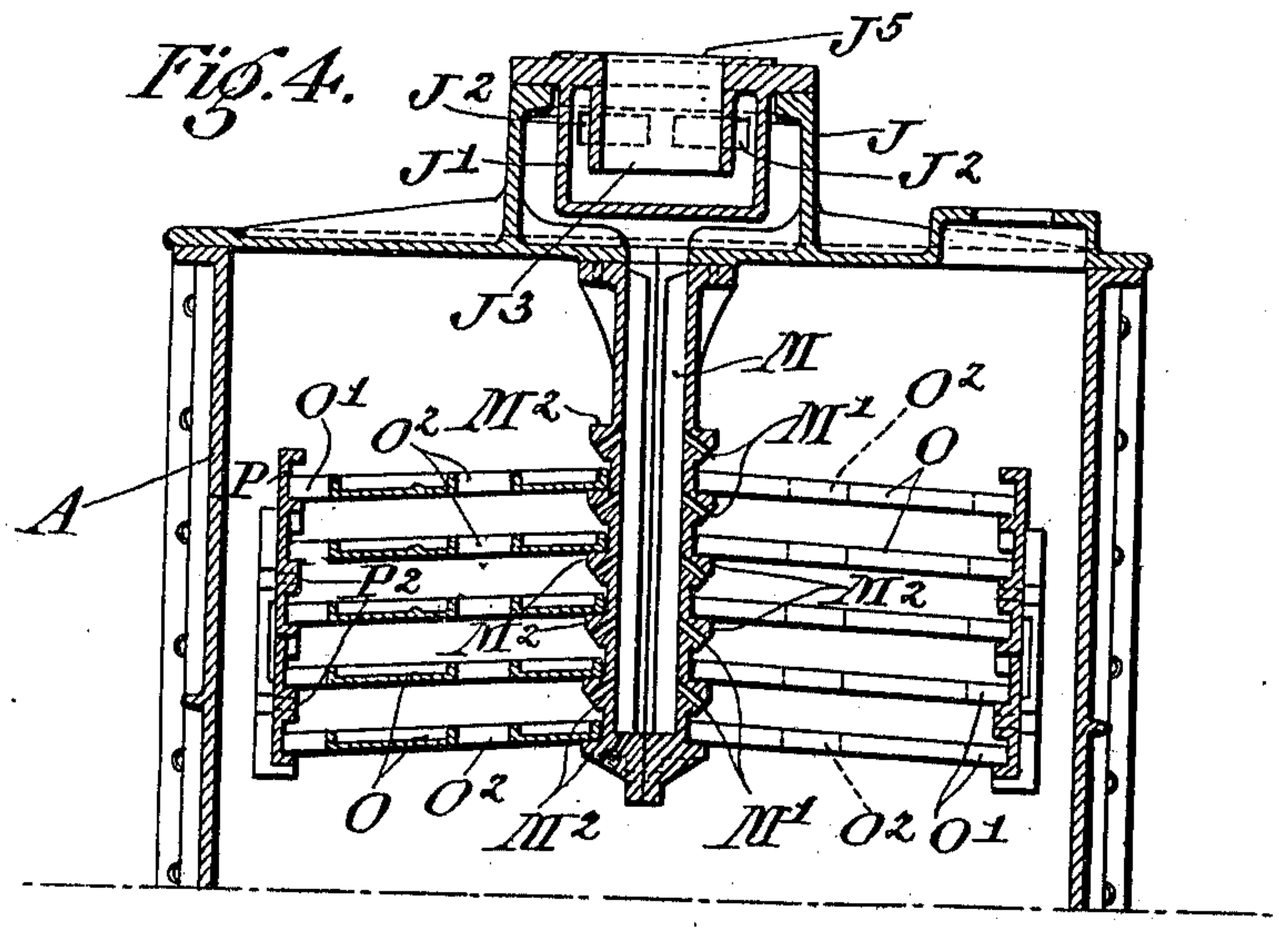

Fig. 5.

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UNITED STATES PATENT OFFICE.

JOSEPH W. GAMBLE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO JOSEPH S. LOVERING WHARTON, WILLIAM S. HALLOWELL, AND JOHN C. JONES, ALL OF PHILADELPHIA, PENNSYLVANIA, DOING BUSINESS AS THE FIRM OF HARRISON SAFETY BOILER WORKS, OF PHILADELPHIA, PENNSYLVANIA.

WATER-HEATER.

991,970. Specification of Letters Patent. **Patented May 9, 1911.**

Application filed October 12, 1910. Serial No. 586,601.

To all whom it may concern:

Be it known that I, JOSEPH W. GAMBLE, a citizen of the United States of America, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Improvement in Water-Heaters, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My present invention relates to water heaters of the kind well known as open feed water heaters and in common use for heating boiler feed water and like purposes. In heaters of this kind a heating chamber is provided into which the water to be heated and steam, (usually exhaust steam from engines), for heating the water are both admitted, provisions being made to insure at all times a steam space in the upper portion of the heating chamber and for causing the water to flow through this space in film like and broken streams. In this type of heater the steam is condensed in whole or in part in the heating chamber and the water of condensation is added to the water being heated.

In the heaters of the kind specified now in use the water is caused to flow in film like and broken streams through the steam space of the heating chamber by means of trays or plate like members interposed between the cold water inlet or inlets at the upper end of the heating chamber and the water level in the chamber. Heretofore it has been universal in the practical use of heaters of this kind to arrange these trays in sets in which some trays are oppositely inclined to and overlap the other so that the general course of the water to be heated is zig zag, flowing successively along first one and then another of the trays until it is discharged at the lower edge of the lowermost tray of the set. I have found, however, that a substantial advantage may be had in some cases by arranging the water spreading trays in one or more sets, each consisting of a group of similarly inclined trays placed one above another and each discharging at its lower end, and by providing in conjunction therewith means for distributing the cold water between and discharging it on the various trays at the upper edges of the latter. By proceeding in the manner specified I cause the water to flow over the various trays of each set in a series of parallel streams instead of in a single zig zag stream. For a given volume of water flowing over a set of trays of given size the film streams are substantially thinner with my present arrangement than the zig zag streams, obtained with the tray arrangement heretofore used, and I have found that the use of the tray arrangement of the present invention in place of the tray arrangements heretofore used results in materially increasing the amount of water which can be heated in a single heater. This increased capacity is particularly marked where the volume of water to be heated is relatively large and the increase in temperature to be given to the water is comparatively small.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of these specifications. For a better understanding of this invention, however, and the advantages possessed by it, reference may be had to the accompanying drawings and descriptive matter, in which I have illustrated and described a form in which the invention may be embodied.

Of the drawings: Figure 1 is an elevation of a heater constructed in accordance with the present invention. Fig. 2 is an elevation taken at right angles to Fig. 1. Fig. 3 is a plan. Fig. 4 is a partial sectional elevation taken generally along the line 4—4 of Fig. 2, but for convenience of illustration the section through the left hand set of trays and the internal water distribution box is taken along the line 4^A—4^A of Fig. 5, and Fig. 5 is a side elevation of the internal water distribution box.

In the drawings, A represents the tank or body of the heater, B the steam supply pipe opening to the interior of the heater tank A through the usual oil separator C.

D and D′ represent the overflow connections adapted to prevent the water level within the heater body from rising above the overflow line X—X.

E represents one hot water discharge connection and F a second hot water discharge connection.

K represents the main cold water supply pipe, and G represents the make-up cold water supply pipe. The flow of water

through the pipe G is regulated by the valve G′ and the valve G′ is automatically controlled through suitable connection by the float H which rises and falls with the water level in the heater body and by opening the valve G′ as the water level falls, prevents the water level from falling below a predetermined level. The make-up cold water supply pipe and the pipe K both discharge into a receptacle or chamber J at the upper end of the heater.

I, represents a vent pipe through which air and any excess steam supplied to the heater may escape.

The particular heater illustrated by the drawings is primarily devised for use in and as a part of a hot water heating system in which the hot water from the heater enters the circulating system through the pipe E and is returned to the heater through the pipe K. The discharge pipe F may be employed to supply a boiler feed pump or the like.

Insofar as above described the construction presents no novelty and as all of the features of construction to which reference has been made are well known I have not thought it necessary herein to describe them in more detail.

From the compartment J the water to be heated passes into the cold water distribution box M located within the heater chamber and in the form shown centrally disposed therein. In the construction illustrated provisions are made for preventing the passage of air or steam out of the heater tank through the chamber J. These provisions comprise a cup shaped partition wall J′ in the chamber J, ported at J^2 and a tubular shell J^3 which depends from the margin of the inlet port J^5 of the chamber into the cup like cavity formed by the wall J′ to a level below the lower edges of the ports J^2. This results in the formation of a water seal between the tubular shell J^3 and the wall J′ which prevents the escape of air or steam from the heater through the chamber J. From the distribution box M, the water passes through ports M′ on to two sets of inclined trays O, located one set on each side of the distribution box, as shown, the trays O in each set are parallel to each other and are inclined downwardly from the distribution box. The trays are supported at their upper edges on ribs M^2 formed on the adjacent sides of the box M and at their lower edges the trays are supported by vertical tray guides P also provided with tray supporting ribs. In the form shown there are two trays placed end to end on each set of tray supporting ribs for the greater convenience in handling the trays, each pair of trays thus placed end to end might be replaced by a single tray twice the size of the single trays shown. As shown the bodies of the trays do not extend to the outer supports P but are formed each with a central tongue or finger O′ which engages the appropriate tray support P. At each side of tongue, each tray, therefore, is spaced away from the corresponding tray support P and the water running down the tray is accordingly discharged into the space between the corresponding tray support P and bodies of the set of trays supported in part by the corresponding tray support P. To facilitate the circulation of steam around the various trays, ports P^2 may advantageously be formed in the tray supports P and ports O^2 may be formed through the tray bodies as shown.

It will be observed that the discharge ports M′ of the distribution box M are arranged to discharge on to each of the trays. The discharge ports M′ may be in the form of slits or rows of apertures and the port or ports M′ for each tray may advantageously be formed as shown in the box rib M^2 above the trays and preferably should be inclined downward at an incline slightly greater than the inclination of the trays. It is desirable that the discharge ports of the distribution box should be so arranged that the water is distributed uniformly between the various trays, and in some cases it may be advantageous to compensate for the difference between the head at the level of the discharge ports M′ for the lowermost pair of trays and the head at the level of the upper trays. This can obviously be done by progressively increasing the aggregate area of the discharge ports M′ from the bottom of the distribution box upward, for instance, where there are a row of discharge ports M^1 for each tray the number of ports in each row may be increased from the bottom to the top as shown in Fig. 4. In many cases, however, the cold water is admitted to the distribution box under such a head that the slight difference in head due to the difference between the levels of the upper and lower ports M^1 may be disregarded as a sufficiently uniform distribution is then had with the aggregate discharge port, are for each tray the same.

When the hot water heater is used in and as part of a hot water heating system as above described, the water returned to the heater through the pipe K would ordinarily be at a temperature of 180° Fahrenheit, while the water supplied to the heating system by the heater would be at a temperature of about 210° Fahrenheit. With this or like range of temperature change to be made in the water passing through the heater, the capacity of the heater is substantially greater when the present invention is employed than is the case with a heater of similar size in which the old zig zag arrangement of trays is employed.

While in accordance with the provisions of the statutes, I have herein disclosed the best form of my invention now known to me, it will be readily apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention, and I do not wish the claims herein made to be limited to the form of apparatus disclosed, more than is made necessary by the state of the art.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a water heater of the kind specified the combination with the heating chamber and the steam supply and hot water discharge connections therefor of one or more sets of inclined trays located in said chamber above the water level therein with the trays in each set arranged one above another and similarly inclined and each discharging at its lower end and means for supplying the water to be heated including provisions for distributing the water between and discharging it upon the various trays at their upper edges.

2. In a water heater of the kind specified the combination with the heating chamber and the steam supply and hot water discharge connections therefor of one or more sets of inclined trays located in said chamber above the water level therein with the trays in each set arranged one above another and similarly inclined and each discharging at its lower end, a cold water distribution box extending alongside each set of trays at the upper edges thereof with a discharge port or ports for each tray in the set through which water may flow from the box onto the corresponding tray and a supply connection to said box.

3. In a water heater of the kind specified the combination with the heating chamber and the steam supply and hot water discharge connections therefor of a cold water distribution box formed with tray supporting lugs at one side and a set of similarly inclined trays arranged one above another and supported at their upper edges on said lugs and said distribution boxes being formed with one or more parts for and arranged to discharge water upon each of said trays.

4. In a water heater of the kind specified, the combination with the heating chamber and the steam supply and hot water discharge connections therefor of a cold water distribution box arranged within the chamber and formed with a vertical series of tray supporting lugs on each of said opposite sides two sets of trays located one on each side of said opposite sides of the box with trays in each set similarly inclined and supported at their upper edges by the lugs on the adjacent sides of the box said box being formed with one or more ports for each tray through which water may pass from the box on to the tray.

5. In a water heater of the kind specified, the combination with the heating chamber and the steam supply and hot water discharge connections therefor of a cold water distribution box arranged within the chamber and formed with a vertical series of horizontal tray support ribs on each of two opposite sides, two sets of trays one at each end of said opposite sides of the box and each consisting of a series of similarly inclined trays arranged one above another and supported each at its upper edge by one of said ribs said box being formed with downwardly inclined discharge ports one or more of which pertain to a point immediately above each of said trays.

6. In a water heater of the kind specified, the combination with the heating chamber and the steam supply and hot water discharge connections therefor of one or more sets of inclined trays located in the said chamber above the water level therein with the trays in each set arranged one above another and similarly inclined and each discharging at its lower end, a water distribution box extending along each set of trays at the upper edges thereof with a discharge port or ports for each tray through which water may flow from the box to the corresponding tray and supply connection to said box; the aggregate discharge port areas for the different trays being varied to compensate for the difference in head of the water in the box at the levels of the different trays.

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Witnesses:
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